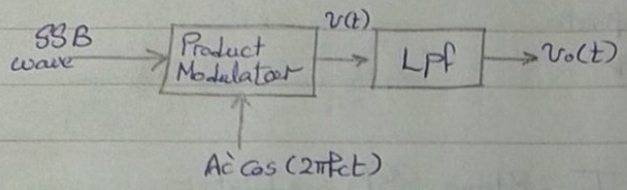
* Demodulation of SSB *

① Coherent Detector

Product modulator & LPF



this signal must be Coherent" Same f and Phase as the Carrier in the SSB wave" for accurate detection.

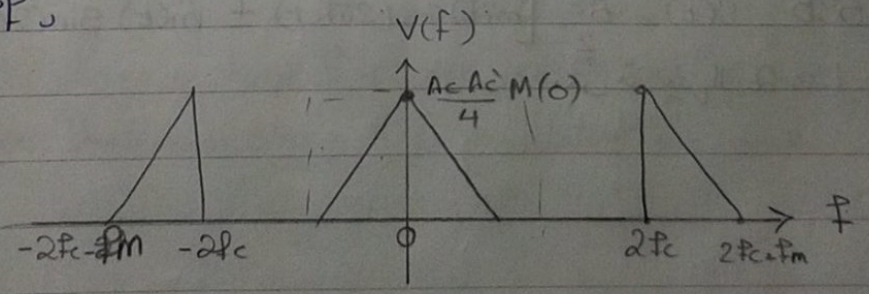
$$v(t) = s(t) * A_c' \cos(2\pi f_c t)$$

$$v(t) = \frac{A_c}{2} \cdot A_c' \cos(2\pi f_c t)\left[m(t)\cos(2\pi f_c t) \pm \hat{m}(t)\sin(2\pi f_c t)\right]$$

$$= \frac{A_c \cdot A_c'}{2}\left[m(t)\cdot \cos^2(2\pi f_c t) \pm \hat{m}(t)\sin(2\pi f_c t)\cos(2\pi f_c t)\right]$$

$$= \frac{A_c A_c'}{2}\left[\frac{m(t)}{2}(1+\cos(4\pi f_c t)) \pm \frac{\hat{m}(t)}{2}\left[\underbrace{\sin(0)}_{0} + \sin(4\pi f_c t)\right]\right]$$

$$= \underbrace{\frac{A_c A_c'}{4} m(t)}_{\text{المطلوب أعدله LPF}} + \underbrace{\frac{A_c A_c'}{4}\left[m(t)\cos(4\pi f_c t) \pm \hat{m}(t)\sin(4\pi f_c t)\right]}_{\text{2fc عند SSB صفر}}$$



$$\therefore v_o(t) = \frac{A_c \cdot A_c'}{4} m(t).$$

If the oscillator's signal $A\grave{c}\cdot\cos(2\pi f_c t)$ subjected

① Freq. shift

$$A\grave{c}\cdot\cos(2\pi f_c t) \longrightarrow A\grave{c}\cdot\cos(2\pi(f_c+\Delta F)t)$$

$$\therefore v(t) = \frac{A_c}{2}\cdot A\grave{c}\cos(2\pi(f_c+\Delta F)t)\cdot\left[m(t)\cdot\cos(2\pi f_c t) \pm \hat{m}(t)\sin(2\pi f_c t)\right]$$

$$= \frac{A_c\cdot A\grave{c}}{2}\left[\frac{m(t)}{2}\cdot\left[\cos(2\pi\Delta F t)+\underbrace{\cos(4\pi f_c t+2\pi\Delta F t)}_{\text{rejected by LPF}}\right]\right.$$

$$\left.\pm\frac{\hat{m}(t)}{2}\left[\sin(\mp 2\pi\Delta F t)+\underbrace{\sin(4\pi f_c t+2\pi\Delta F t)}_{\text{rejected by LPF}}\right]\right.$$

$$\cdot \sin A * \cos B = \frac{1}{2}\left[\sin(A-B)+\sin(A+B)\right]$$

$$\therefore v_o(t) = \frac{A_c\cdot A\grave{c}}{4}\cdot\left[m(t)\cos(2\pi\Delta F t)\mp\hat{m}(t)\sin(2\pi\Delta F t)\right]$$ ← SSB 신호

② Phase shift

$$A\grave{c}\cos(2\pi f_c t) \longrightarrow A\grave{c}\cdot\cos(2\pi f_c t+\phi)$$

$$\therefore v(t) = \frac{A_c}{2}\cdot A\grave{c}\cos(2\pi f_c t+\phi)\cdot\left[m(t)\cos(2\pi f_c t)\pm\hat{m}(t)\sin(2\pi f_c t)\right]$$

$$= \frac{A_c\cdot A\grave{c}}{2}\left[\frac{m(t)}{2}\left(\cos(\phi)+\underbrace{\cos(4\pi f_c t+\phi)}_{\text{rejected by LPF}}\right)\pm\frac{\hat{m}(t)}{2}\left(\sin(-\phi)+\underbrace{\sin(4\pi f_c t+\phi)}_{\text{rejected by LPF}}\right)\right]$$

$$= \frac{A_c A\grave{c}}{4}\left[m(t)\cos\phi\mp\hat{m}(t)\sin(\phi)\right]. \longrightarrow \text{SSB 신호}$$

So $m(t)$ can't be detected